

# Observations on systematics of Sessile Barnacles from West Coast of India-1<sup>1</sup>

BY

ARUN B. WAGH<sup>2</sup> AND D. V. BAL<sup>3</sup>

(With ten text-figures)

## INTRODUCTION

Studies on systematics of any group of animals is an essential prerequisite for bio-ecological investigation. The present studies were undertaken with this view and have been followed by investigations on various aspects of bio-ecology of barnacles which are being published elsewhere.

## MATERIAL AND METHODS

The present paper contains a description of sessile barnacles collected from the coast of Maharashtra which is the area lying between 20°05'N to 15°48'N on the west coast of India. The collections were made from the intertidal region.

The usual method of treating the valves, compartments, mouth-parts and other appendages of the specimens with caustic potash, was employed. For staining, borax-carmines as well as micro-indigocarmine stains were used. The diagrams were drawn with the aid of camera lucida.

## OBSERVATIONS

A classified list of the various forms described is as follows:  
Sub-order BALANOMORPHA Pilsbry, 1916.

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<sup>1</sup> Accepted February 13, 1970.

<sup>2</sup> National Institute of Oceanography, Panaji—Goa.

<sup>3</sup> Kirti College, Bombay 400 028.

Family CHTHAMALIDAE Darwin, 1854.

Genus *Chthamalus* Ranzani, 1817.

1. *Chthamalus malayensis* Pilsbry, 1916.

2. *Chthamalus withersi* Pilsbry, 1916.

Family BALANIDAE Gray, 1925.

Sub-family Balaninae Darwin, 1854.

Genus *Balanus* Da Costa, 1778.

Sub-genus *Megabalanus* Hoek, 1913.

3. *Balanus tintinnabulum* var. *tintinnabulum* Linne, 1758.

Sub-genus *Balanus* Da Costa, 1778.

4. *Balanus amphitrite* var. *communis* Darwin, 1854.

5. *Balanus amphitrite* var. *venustus* Darwin, 1854.

6. *Balanus amphitrite* var. *stutsburi* Darwin, 1854.

7. *Balanus amphitrite* var. *hawaiiensis* Broch, 1922.

Sub-genus *Chirona* Gray, 1835.

8. *Balanus amaryllis* Darwin, 1854.

forma *euamaryllis* Broch, 1922.

Sub-family Chelonibiinae Pilsbry, 1916.

Genus *Chelonibia* Leach, 1817.

9. *Chelonibia testudinaria* Linne, 1758.

10. *Chelonibia patula* Ranzani, 1818.

Sub-family Tetracitinae Nilsson-Cantell, 1921.

Genus *Tetracitita* Schumacher, 1817.

11. *Tetracitita* (*Tetracitella*) *purpurescens* Wood, 1818.

#### SPECIES DESCRIPTION

##### ***Chthamalus malayensis* Pilsbry, 1916. (Figure 1)**

*Remarks:* The specimens conforming to both types, namely *Ch. malayensis* as well as *Ch. moro* were collected. However, all the forms have been described as *Ch. malayensis* because the view point of Utinomi (1954) and Karande & Palekar (1963) is being followed.

Colour of the shell, externally, varies from light brown to grey-brown. Some forms exhibited slightly greenish tinge. The diameter of the shell varies from 5-6 mm to 10-12 mm. Opercular valves resemble with those described by Utinomi (1954). Tergum bears 4-5 short crests for the attachment of depressor muscles.

Mandible possesses 3 or 4 teeth. The row of spines below the fourth tooth consists of 10-14 spines. Maxilla has three upper spines which are separated by a small notch from the lower spines. Hairy labrum bears 16-17 teeth out of which first two are comparatively longer and more stout. Cirrus II is with both, toothed and serrated types of spines.

*Localities:* Bombay (north and south), Alibag, Murud-Janjira, Shri-

wardhan, Harnai, Ladghar, Jaigad, Nandivade, Ganapati-Pule, Ratnagiri, Vijaydurg, Deogad, Malvan, Vengurla, Redi.

*Distribution:* Indian Ocean and Malay Archipelago.

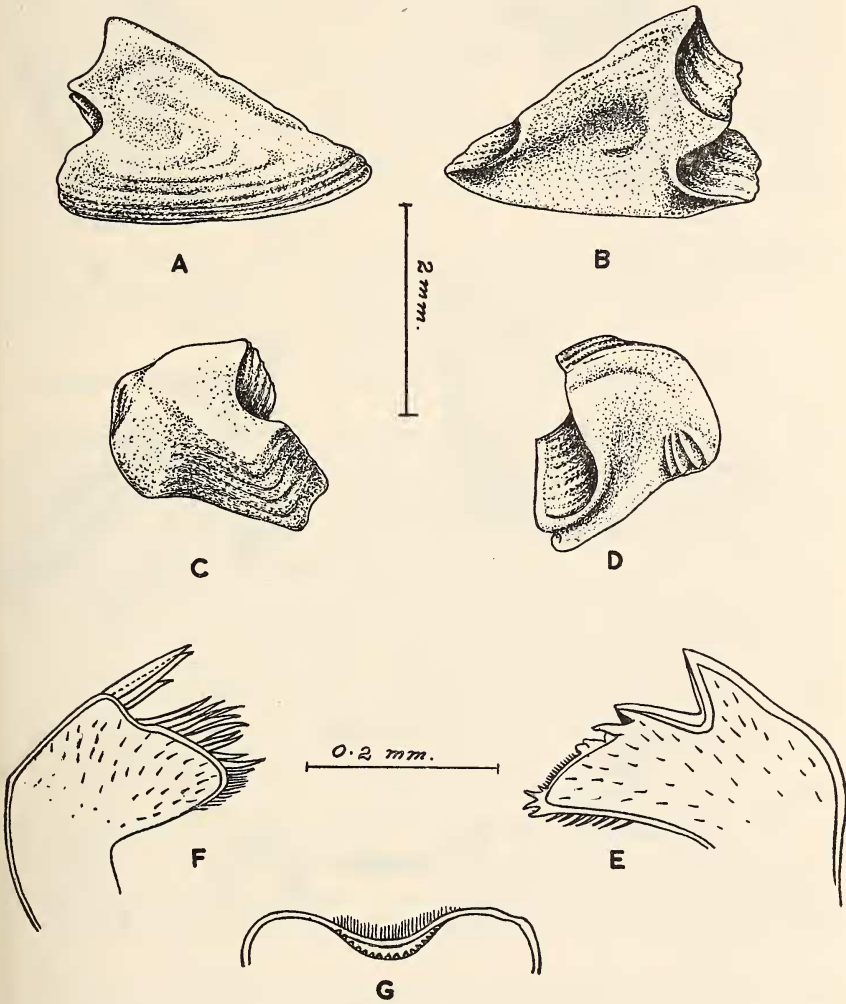


Fig. 1. *Chthamalus malayensis* Pilsbry

Opercular valves and mouth-parts

A. Scutum — outer view; B. Scutum — inner view; C. Tergum — outer view; D. Tergum — inner view; E. Mandible; F. Maxilla I; G. Labrum (labial palps not shown).

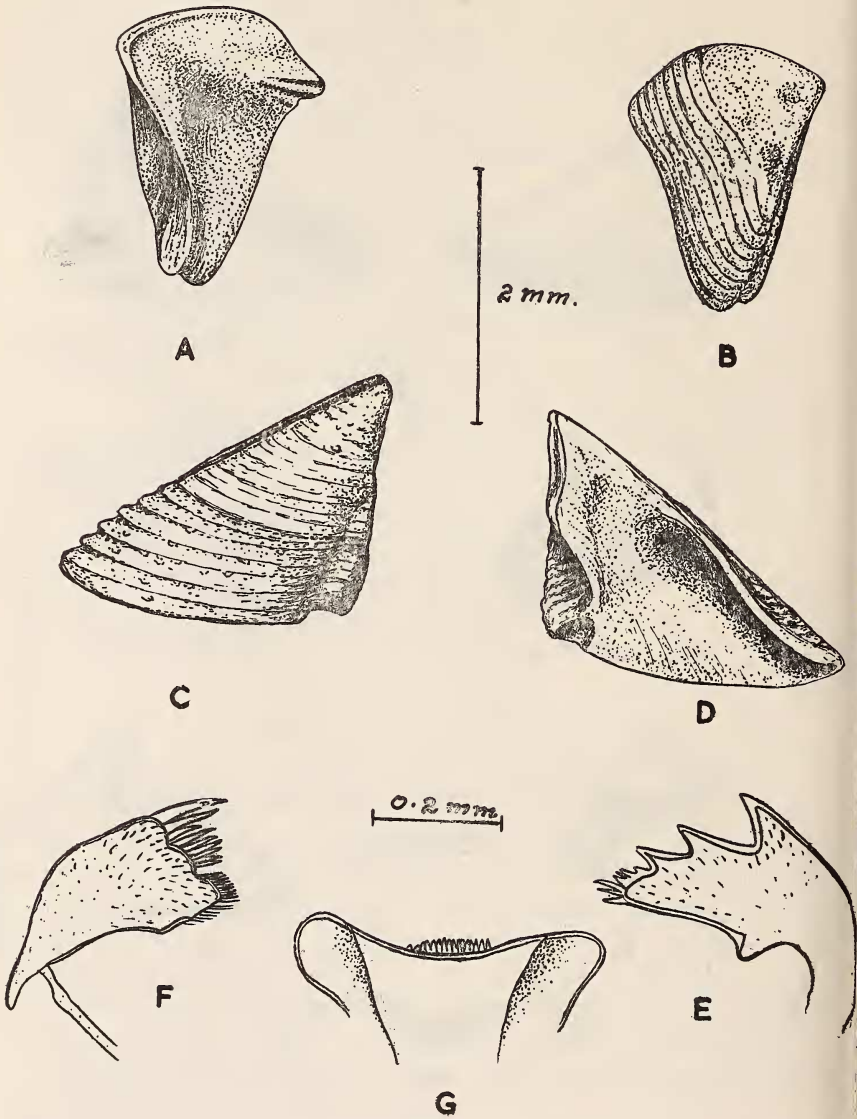


Fig. 2. *Chthamalus withersi* Pilsbry

Opercular valves and mouth parts

A. Tergum — inner view; B. Tergum — outer view; C. Scutum — outer view; D. Scutum — inner view; E. Mandible; F. Maxilla I; G. Labrum (labial palps not shown).

**Chthamalus withersi** Pilsbry, 1916. (Figure 2)

*Remarks:* Colour, dirty brown or dirty grey. Carino-rostral diameter 6-7 mm. Compartments without ridges, with simple sutures and broad alae. The description of opercular valves generally agrees with that given by Nilsson-Cantell (1938). Thus, spur is almost united with the basi-scutal angle. Similarly, the narrow carinal lobe with few crests for the depressor muscle is also found to be present. Scutum, however, bears a distinct pit for the lateral depressor muscle and thereby differs from that described by Nilsson-Cantell.

Mandible bears 3 teeth and a pecten of 6-7 spines. Edge of maxilla has two notches thereby dividing the spines into three groups. Out of them, upper two spines look more stout. Labrum bears numerous minute teeth.

*Localities:* Bordi, Gholvad, Bassein, Bombay (south), Elephanta, Anjarle, Ganapati-Pule, Ratnagiri, Deogad, Malvan, Shiroda.

*Distribution:* Indian Ocean, Malay Archipelago.

**Balanus tintinnabulum tintinnabulum** Linne, 1758. (Figure 3)

*Remarks:* The present collection contains two different sets of individuals. Those collected from Madh Island, Bandra and Chowpatty rocks (all grouped under Bombay) have blackish purple compartments that are moderately ribbed longitudinally and with conical shape. The specimens collected at other localities have tubulo-conical shells; the compartments smooth and purplish-pink in colour. Shell-walls and the opercular valves of the former are quite thick as compared to those of the latter. Size of the shells varies from 35 mm to 60 mm in their basal diameters. Opercular valves agree with those described by Hiro (1939). The scutum, however, shows a slight difference by possessing a well-developed pit for the lateral depressor muscle.

Mandible has 5 teeth, of which, the second and third are bifid. Maxilla I has a straight edge with its spines arranged in three groups. Labrum shows 1-2 teeth on either side of the median notch.

*Localities:* Bombay, Murud-Janjira, Harnai, Ladghar, Nandivade, Ganapati-Pule, Ratnagiri, Vijaydurg, Mumbri, Malvan, Vengurla and Redi.

*Distribution:* Definitely known from Mediterranean sea, Atlantic and Indian Ocean.

**Balanus amphitrite communis** Darwin, 1854. (Figure 4)

*Remarks:* Coloration of shell shows a great degree of variation. Most of them have pink coloured stripes whereas some exhibit dark brown stripes. Shape of shell conical, but a few of them were tubulo-conical, probably due to crowding.

Scutum is reddish brown externally and bears a conspicuous white stripe along its tergal margin. Mandible has 5 teeth of which the fourth and fifth are small and knob-like. Maxilla I has a straight edge. Labrum deeply notched with teeth on either side of it, numbering from 4 to 8. Some workers are of the opinion that multi-denticulated forms should be grouped under variety *denticulata*. However, Nilsson-Cantell (1938), Tarasov and Zerina (1957) have grouped even multidenticulate forms

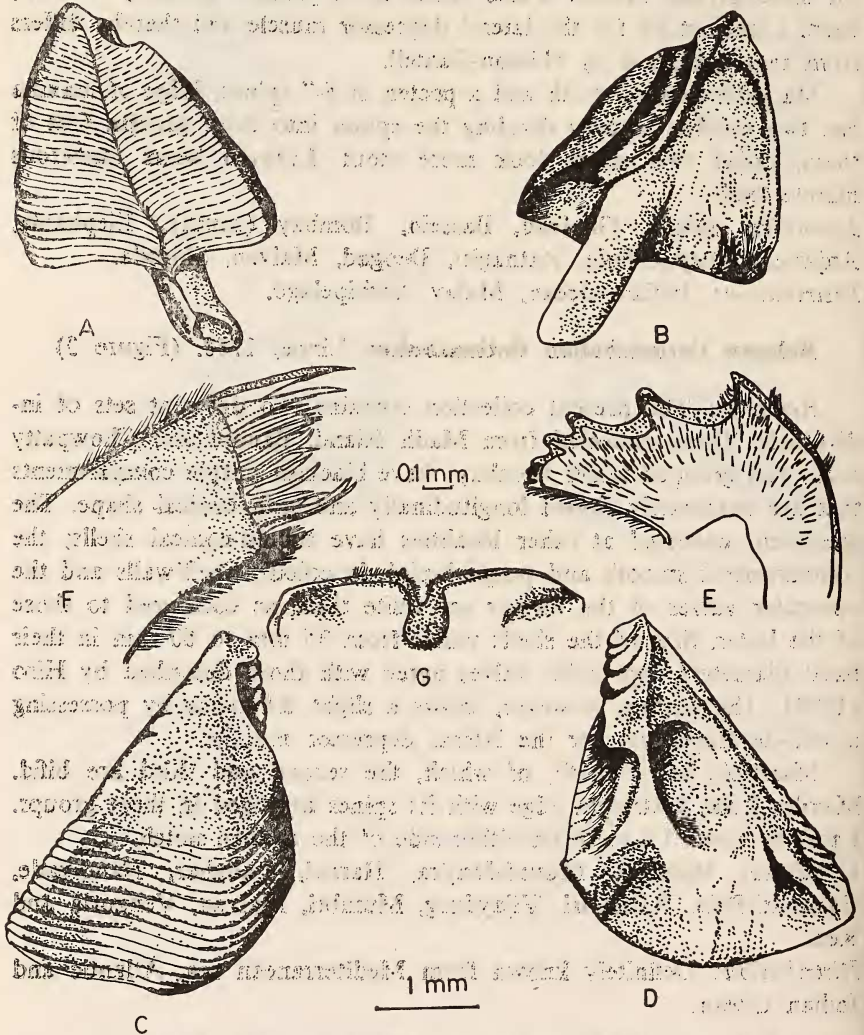


Fig. 13. *Balanus tintinnabulum tintinnabulum* Linn.

Opercular valves and mouth parts  
 A: Tergum — outer view; B: Tergum — inner view; C: Scutum — outer view;  
 D: Scutum — inner view; E: Mandible; F: Maxilla I; G: Labrum (labial palps  
 not shown).

under var. *communis* on the contention that it is merely a minor variation which does not warrant the creation of a separate variety. In the present investigations the latter view has been accepted.

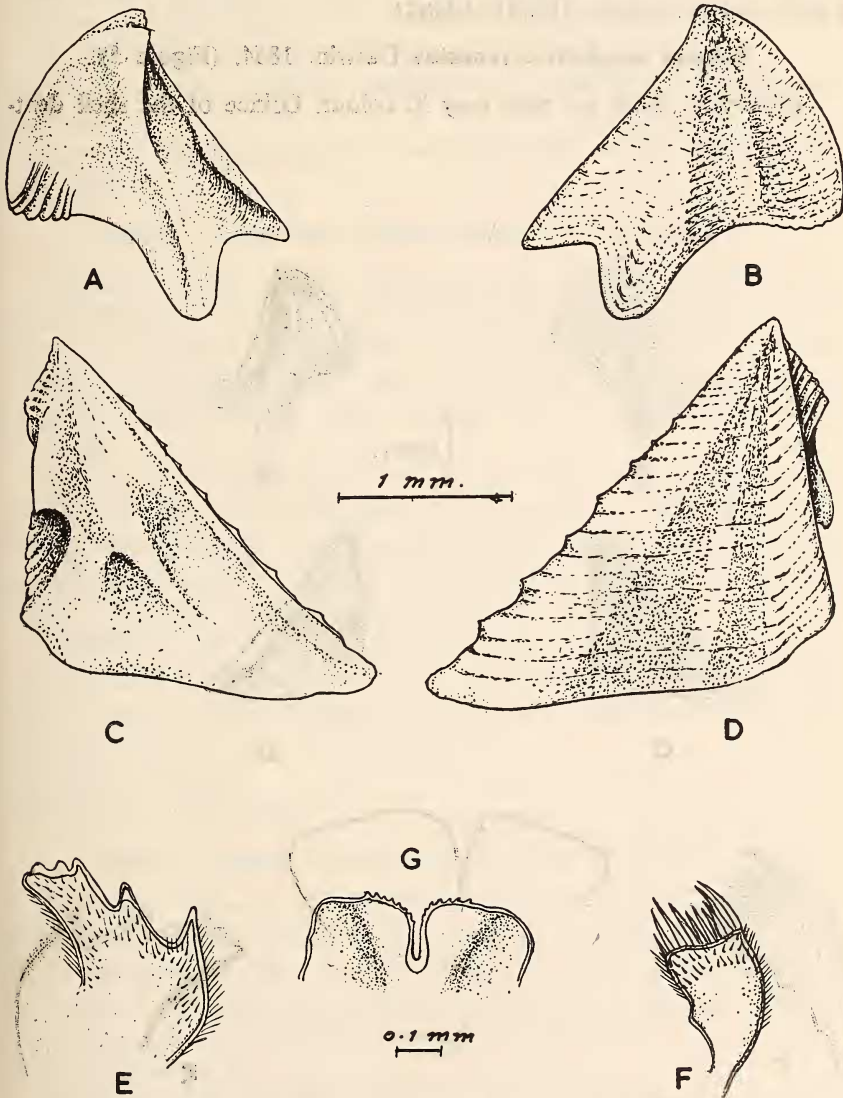


Fig. 4. *Balanus amphitrите communis* Darwin  
Opercular valves and mouth parts

A. Tergum — inner view; B. Tergum — outer view; C. Scutum — inner view; D. Scutum — outer view; E. Mandible; F. Maxilla I; G. Labrum (labial palps not shown).

*Localities:* Bombay, Elephanta, Alibag, Shriwardhan, Harnai, Dabhol, Jaigad, Nandivade, Ganapati-Pule, Ratnagiri, Vijaydurg, Deogad, Malvan, Vengurla, Tak, Shiroda and Redi.

*Distribution:* West India, European waters, Mediterranean, west and south Africa, Indian Ocean, Malay Archipelago, New South Wales, Pacific Ocean, Japan, Hawaii Islands.

**Balanus amphitrite venustus** Darwin, 1854. (Figure 5)

*Remarks:* Shells are pale rosy in colour. Orifice of the shell dent-

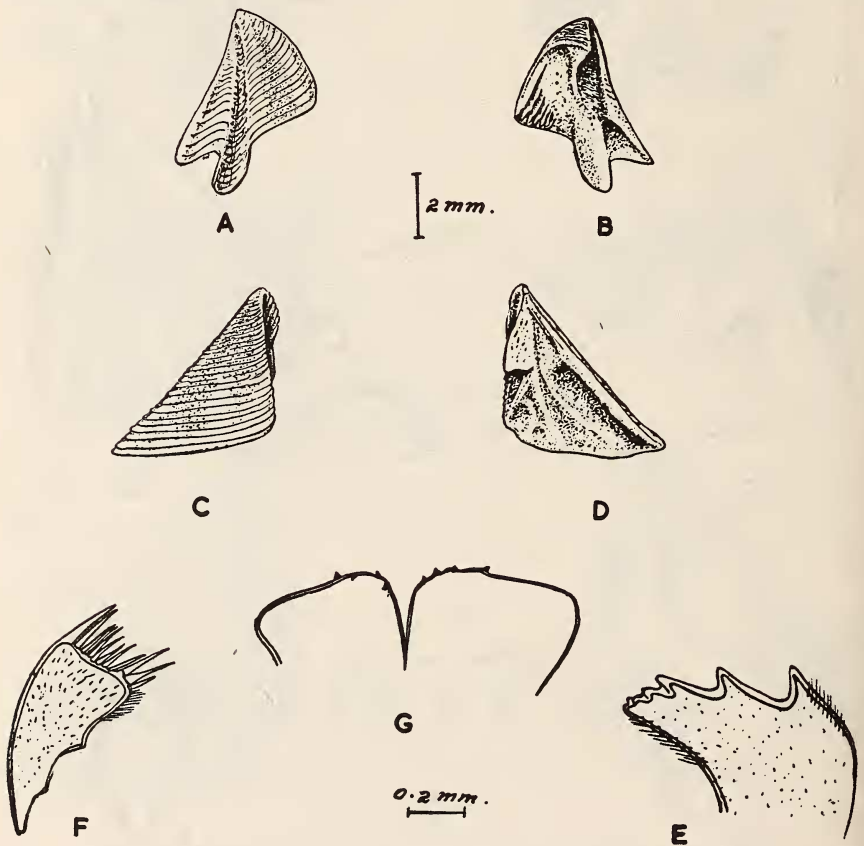


Fig. 5. *Balanus amphitrite venustus* Darwin

Opercular valves and mouth parts

A. Tergum — outer view; B. Tergum — inner view; C. Scutum — outer view; D. Scutum — inner view; E. Mandible; F. Maxilla I; G. Labrum (labial palps not shown).



ated. Raddi are narrow with their summits parallel to the base. Tergum possesses a broad, inclined spur with rounded head. Basi-scutal angle is quite acute, thereby giving it a pointed appearance. Scutum is very thin and bears a well-developed articular ridge. Mandible has 5 teeth of which the fourth and fifth are knob-like. Maxilla I has almost a straight edge bearing two pairs of long spines with 7 smaller spines in between them. Labrum with a deep and narrow median notch. On either side of the notch are 4 teeth.

*Localities:* Bandra, Jaigad, Ganapati-Pule, Ratnagiri, Vengurla and Shiroda.

*Distribution:* Mediterranean sea, west and south Africa, Indian Ocean and Japan.

***Balanus amphitrite stutsburi* Darwin, 1854. (Figure 6)**

*Remarks:* About twelve specimens settled on a wooden test panel were collected at Trombay (Bombay). They are all 'typical *stutsburi*' forms. As described by Stubbings (1961) the shell is conical and has a robust appearance. There is also incurving of the compartments towards the shell opening, so that the shell presents a convex appearance in profile.

Tergum is of typical shape with its spur very much elongated. The longitudinal furrow is represented by a depression. The basi-carinal lobe is well-developed and bears on its inner surface crests for tergal depressors. Scutum has well-developed, adductor as well as articular ridge. Pit for the lateral depressor is quite pronounced.

Mandible bears 5 teeth and 2-3 spinelike projections at its lower angle. Maxilla I has the lower part of its edge slightly protruded which in turn carries a pair of long spines. Labrum has deep median notch with 3-4 teeth on either side of it.

*Localities:* Trombay.

*Distribution:* West Africa.

***Balanus amphitrite hawaiiensis* Broch, 1922. (Figure 7)**

*Remarks:* Colour of the shell dirty white with violet vertical stripes. Shell has a large rhomboid orifice and thick compartments. Apex of the rostral plate is either straight or slightly incurved. The opercular valves agree in appearance with those described by Utinomi (1960). The suture between two opercular valves of the same side present a sinuous appearance.

Mandible bears 5 teeth. Maxilla I is of the typical *B. amphitrite* shape. Labrum bears numerous teeth on either side of the notch. Based on this character alone, Broch (1922) created variety *denticulata*. However, as stated previously, it is being treated as minor variation in the present communication and hence the forms are assigned either

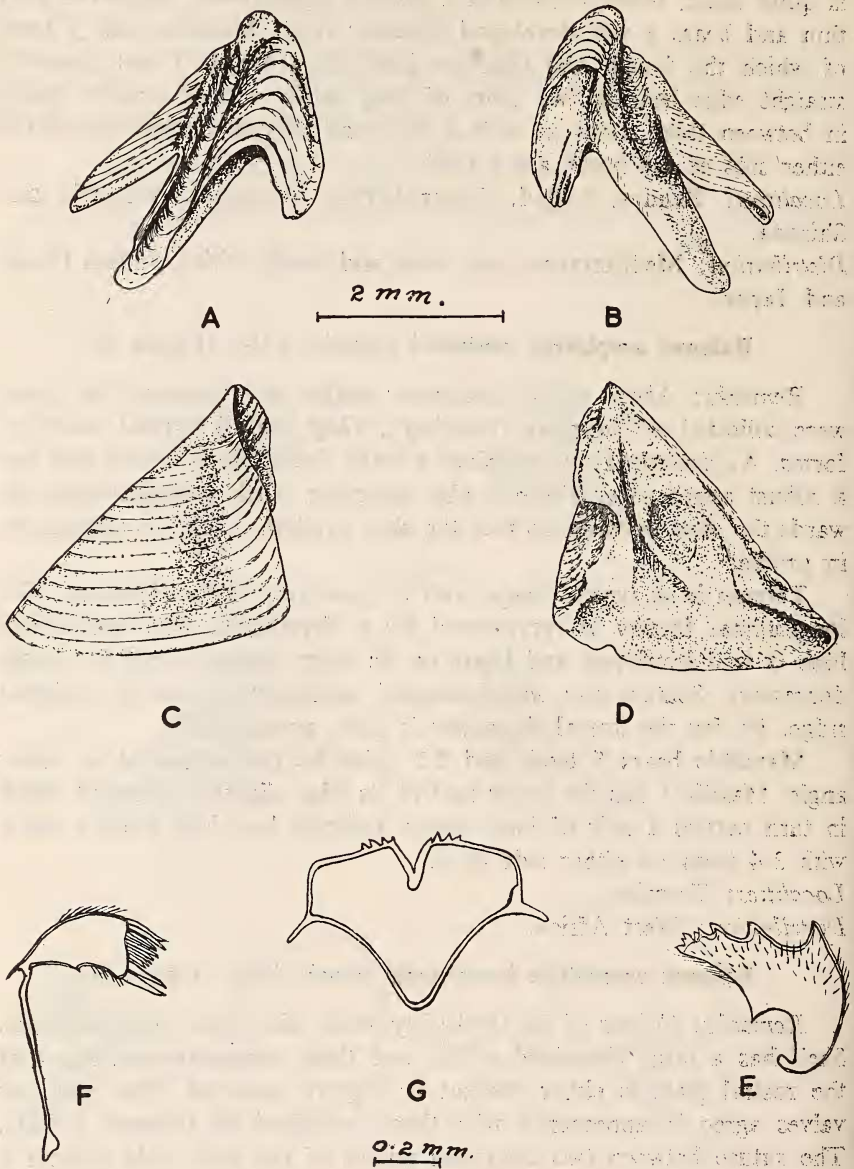


Fig. 6. *Balanus amphitríte stutsburi* Darwin

Opercular valves and mouth parts

A. Tergum — outer view; B. Tergum — inner view; C. Scutum — outer view; D. Scutum — inner view; E. Mandible; F. Maxilla I; G. Labrum (labial palps not shown).

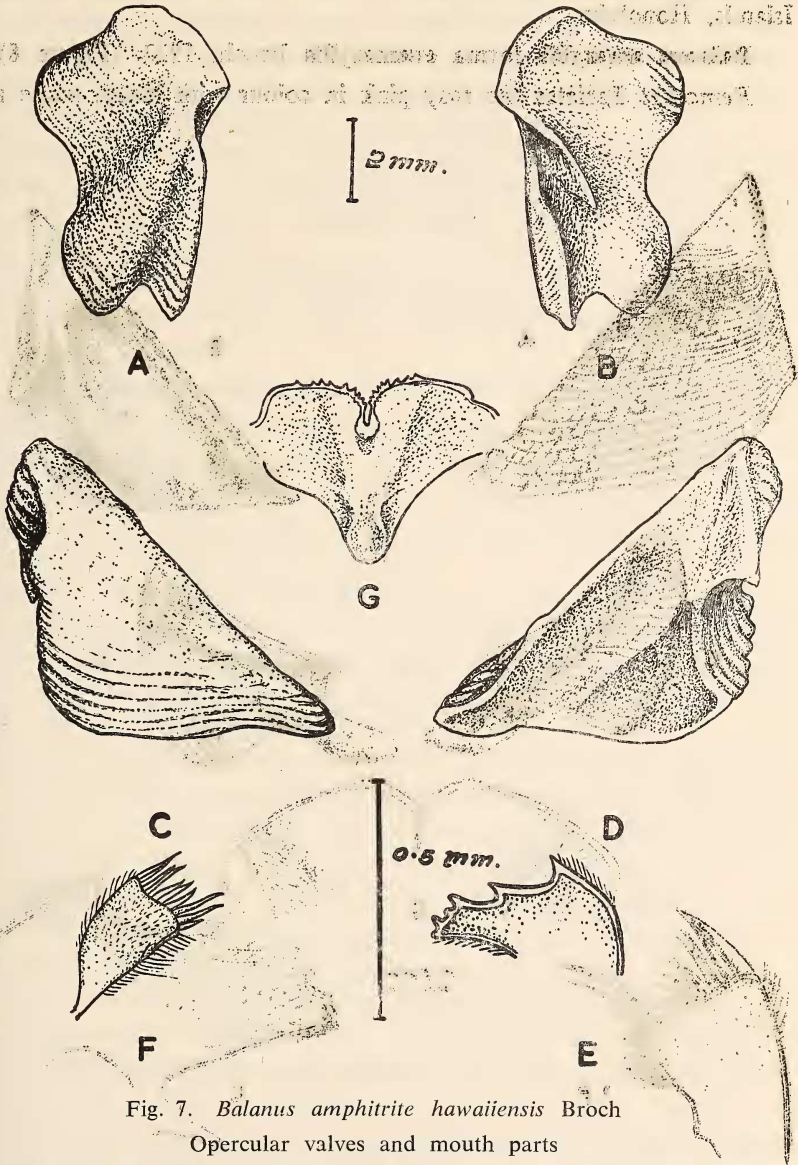


Fig. 7. *Balanus amphitrite hawaiiensis* Broch  
Opercular valves and mouth parts

A. Tergum — outer view; B. Tergum — inner view; C. Scutum — outer view; D. Scutum — inner view; E. Mandible; F. Maxilla I; G. Labrum (labial palps not shown).

to *communis* or *hawaiiensis* variety depending upon their entire set of characters.

*Localities:* Gholvad, Bombay, Elephanta, Dabhol, Harnai, Tak and Aronda.

*Distribution:* Indian Ocean, Persian Gulf, Malay Archipelago, Hawaii Islands, Honolulu.

**Balanus amaryllis** forma *euamaryllis* Broch, 1922. (Figure 8)

*Remarks:* Parietes are rosy pink in colour with bluish white alae.

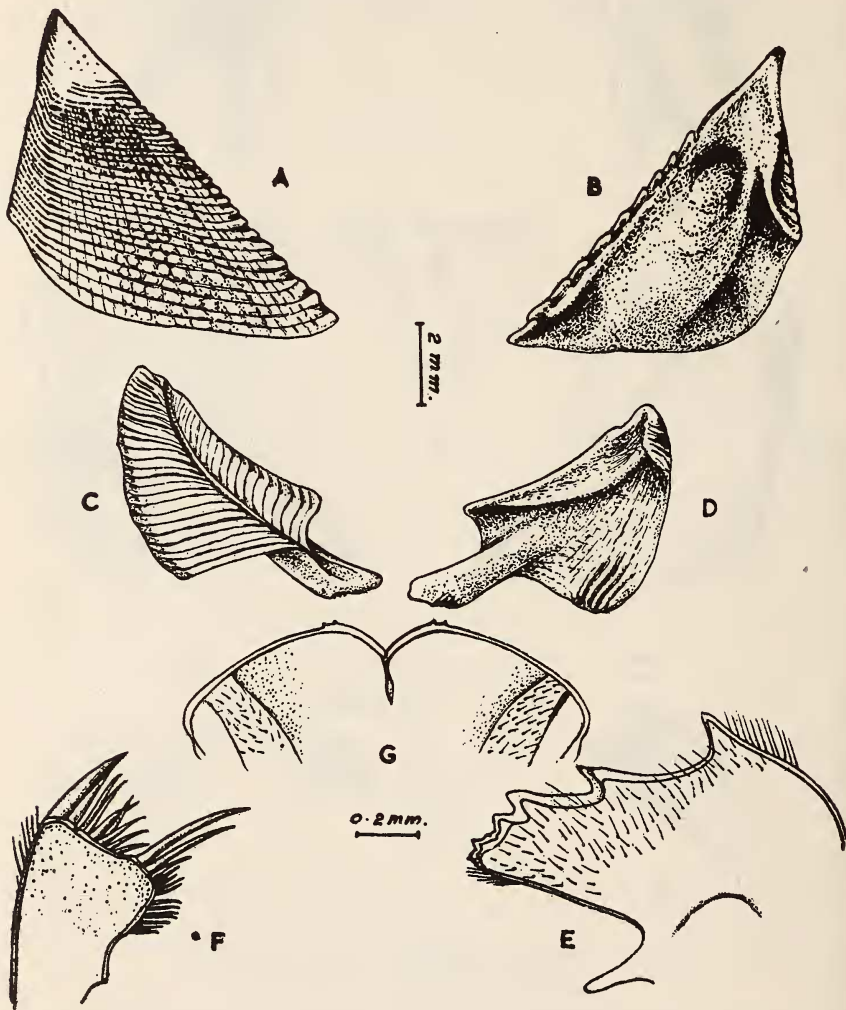


Fig. 8. *Balanus amaryllis* Darwin forma *euamaryllis* Broch

Opercular valves and mouth parts

A. Scutum — outer view; B. Scutum — inner view; C. Tergum — outer view; D. Tergum — inner view; E. Mandible; F. Maxilla I; G. Labrum (labial palps not shown).

Radii are oblique and are covered by persistent yellow epidermis. Alae are comparatively broader.

Tergum externally bears a deep longitudinal furrow which is closed in fully grown specimens. Spur is long and narrow with its end bluntly pointed. Scutum is plainly striated longitudinally, with the striae dividing the lines of growth into squarish beads. Depression for the attachment of lateral depressor muscle is quite deep.

Mandible bears 5 teeth of which the second one is large and double. Maxilla I bears a pair of long spines at the apex and another pair at base with 7 shorter spines in between. Labrum has 2-3 small teeth on either side of the notch.

*Localities:* Cuffe Parade, Chowpatty, Breach Candy, Manori.

*Distribution:* Indian Ocean, Malay Archipelago, China, Japan, northern coast of Australia.

### **Chelonibia testudinaria** Linne 1761. (Figure 9)

*Remarks:* Fourteen specimens were obtained from the back of a sea-turtle (*Eretmochelys imbricata*) that was brought to the Taraporevala Marine Biological Station, Bombay. All the specimens were fairly well-developed and had attained large size; some of them admeasuring 45 mm in their rostro-carinal diameter.

*Remarks:* Shell much depressed and oval in outline. Colour dirty white. Parietes are thick with numerous vertical plates extending from the outer lamina towards the inner lamina. Radii are narrow. A hard, yellow and horny membrane representing the articular ridge of the tergum unites the tergum and scutum.

Labrum bears numerous teeth on either side of the notch. Mandible has 5 teeth of which the second and third are double. Lower angle of mandible is pectinated. Maxilla I is without any notch and its straight edge bears 15-16 spines without any definite pattern.

*Distribution:* Tropical and temperate seas, attached to turtles.

### **Tetraclita (Tetraclitella) purpurascens** Wood, 1818. (Figure 10)

*Remarks:* Shell coloration of these forms is dirty brown or greenish in the field. However, on cleaning the shell it becomes white or greyish white. Shell is much depressed with 22-28 ribs on its outer surface. Compartment walls are thick with parietal tubes arranged in rows. Radii are broad with horizontal summits.

Scutum transversely elongated and with the pit for depressor muscle being indistinct. Tergum has extremely short spur that is situated very close to basi-scutal angle. Crests for the depressor muscle well-developed and are six in number.

Mandible bears 5 teeth with third and fourth being double. The lower angle is pectinated. Maxilla I slightly notched.

*Localities:* Bombay-Cuffe Parade, Madh Island, Breach Candy.

*Distribution:* Madagascar, Malay Archipelago, China and India.

**Chelonibia patula** Ranzani, 1820.

Four specimens were found attached to a spiny lobster, *Panulirus polyphagus* (Herbst).

*Remarks:* Shell is light, fragile and loosely cemented. Raddi are broad and smooth. The opercular valves are very much similar to those of *Chelonibia testudinaria* but narrow comparatively.

*Distribution:* Atlantic Ocean, Mediterranean Sea, Indian Ocean, Malay Archipelago, Pacific Ocean.

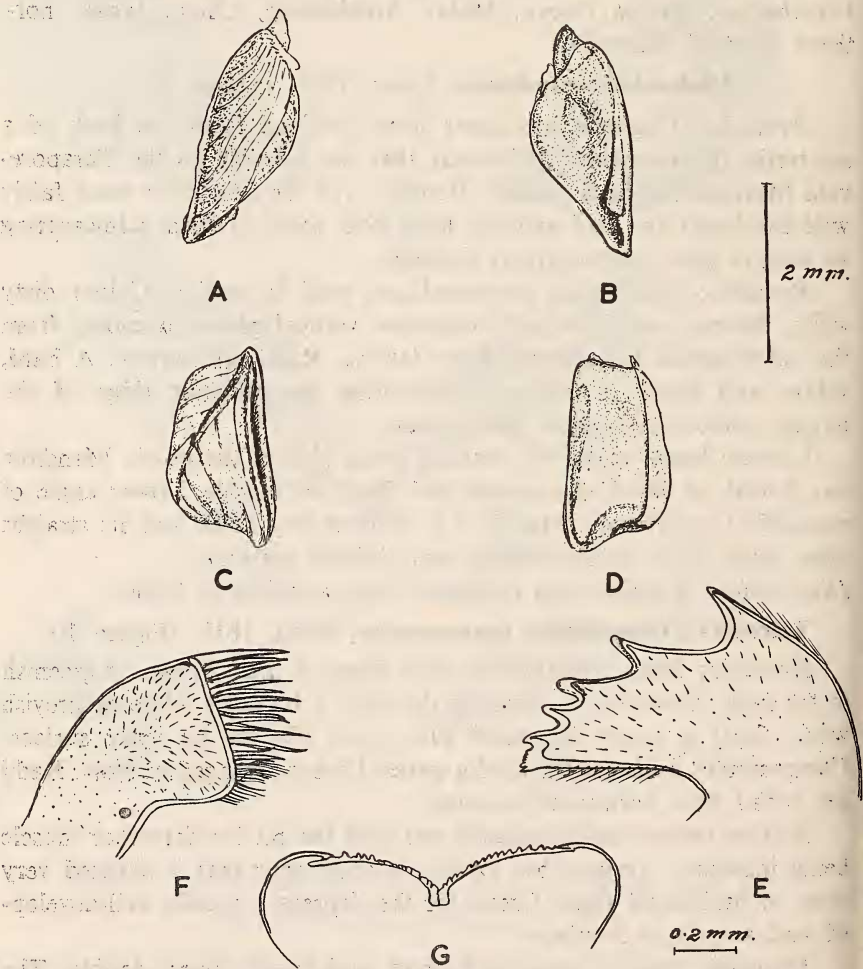


Fig. 9. *Chelonibia testudinaria* Linn.  
Opercular valves and mouth parts.

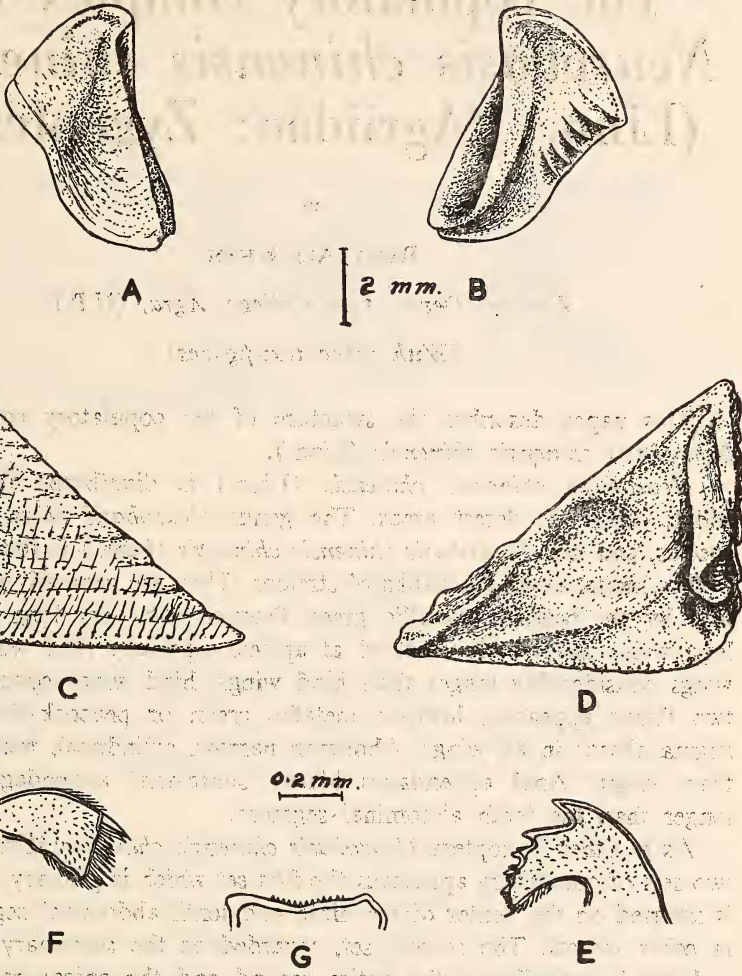


Fig. 10. *Tetraclitella* (*Tetraclitella*) *purpureus* Wood  
Opercular valves and mouth parts.

Key to abbreviations for Figs. 9 & 10.

- A. Tergum — outer view; B. Tergum — inner view; C. Scutum — outer view;
- D. Scutum — inner view; E. Mandible; F. Maxilla I; G. Labrum (labial palps not shown).

(to be continued)